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Method of sealing plug-in connection elements of electrical line systems when foaming them in place in components, and devices to be used for this method

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~~The subject-matter of the invention is a method with the features of Claim 1 and a device to be used for this method with the features of Claim 4.~~

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If it is wished to foam line systems in place in components, such as the door modules for motor vehicles for example, plug-in connection elements are required in order to allow later connection of the loads concerned. These are preferably likewise foamed in place in such a way that only the opening in this connection element into which the corresponding part concerned is later inserted remains freely accessible. During foaming in place there is then the risk of the initially very liquid foam being easily able to penetrate through the opening in the body of the plug-in connection element, for leading through the leads, into the body and consequently rendering the entire arrangement unusable.

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This risk is to be countered by the method according to the invention and the device to be used for this method according to the invention.

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The problem which consequently arises according to the invention is solved by the entry point of the electrical conductor into the plug-in connection element being sealed by a closure part under the pressure of the foam to be introduced. This closure part may have two flexible lips, which lie against each other and enclose the electrical lead, or comprise a component which corresponds to the outwardly widening opening for the insertion of the leads. Both solutions

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are explained in more detail with reference to the attached drawing.

In these drawings:

Figure 1 shows an embodiment of the closure
5 part with sealing lips

Figure 2 shows an enlarged partial view of
Figure 1

Figure 3 shows a plan view of the closure part
according to one embodiment

10 Figure 4 shows a plan view of the closure part
according to another embodiment

Figure 5 shows a modification of the closure
part of Figure 3 or 4

Figure 6 shows another embodiment with a
15 sealing plug-like closure part.

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Figure 1 shows a first embodiment of the
invention, with a plug-in connection element (1) in
cross section, the design of which may be formed as
desired according to the intended use and which is
20 foamed in place in the foam (2). This plug-in
connection element has on the one hand contacts (only
indicated) for the later connection of a load and on
the other hand the connection to a lead (3), which may
comprise a single line or a plurality of single
25 electrical lines of a known type (round-conductor
ribbon, flat-conductor ribbon, webbed ribbon conductor
or the like). This lead (3) is led through the closure
part (4), which has two flexible lips which lie against
each other and enclose the lead (3). The closure part
30 (4) may be fitted onto the body of the plug-in
connection element (see Figure 2), moulded onto the
body or connected to it in another suitable way, or if
the body is of a suitable material may be produced
integrally with it.

35 The design of the lips lying against each other
depends on the type of leads (3) to be led through.
Figure 3 shows one embodiment in plan view, in which
the lead (3) is a webbed ribbon conductor. In this
case, the lip parts (5a, 5b), which meet along the line

(6), have cutouts (7) adapted to the cross section of the individual wires of the webbed ribbon conductor.

If a plug-in connection element with a closure part (4) designed in such a way is foamed in place in a component, such as a car door for example, the expanding foam presses the flexible lips (5a, 5b) against each other and in the direction of the body of the plug-in connection element (1) and brings about a sealed termination, which prevents foam from penetrating into this body.

Figure 4 shows another design, for the case in which the lead (3) comprises a flat conductor. Then, the lips have to leave only a narrow gap (8), the insertion of the flat conductor then preferably being made easier by one side of the closure part (4) having a cut opening (9).

The pressure applied by the foam can be intensified by providing surface-area enlargements on the lips, in the form of lugs or additional ridges (10), as Figure 5 shows by way of example.

Another embodiment of the solution according to the invention is represented in Figure 6, in which the opening of the plug-in connection element (1) through which the lead (3) is inserted is widened outwards in cross section in a funnel-shaped manner and the closure part (11), consisting of a flexible material, has a corresponding, tapering form, as Figure 6 in particular clearly shows. Depending on the type of lead (4) to be inserted, this closure part (11) may adopt a wide variety of forms. For example, in the case of a single line, the closure part may have a conical shape, while for a flat conductor ribbon an elongated design that is rectangular in cross section perpendicularly with respect to the direction of the line, with tapering side and end faces, can be used. The opening in the plug-in connection element, widening in a funnel-shaped manner, is then correspondingly designed.

a The sealing effect can be intensified by providing the closure part with a sealing collar (12),

as shown in Figure 7

which can come to bear in a sealed manner on the end face of the plug-in connection element. The sealing between the closure part (11) and the lead (3) can be improved if peripheral cam strips (13) are provided on the closure part. This achieves the effect that the flexible closure part (11) is deformed in the direction of the lead when, during foaming in place, the closure part is pressed into the opening in the plug-in connection element by the pressure of the foam.

10 A wide variety of materials can be used for the closure part according to both embodiments described above and all modifications that are obvious to a person skilled in the art, provided that they are adequately flexible or can be deformed under the pressure of the expanding foam.

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